Ministry of
Energy, Mines and
Petroleum Resources
Hon. Jack Davis, Minister

Canadian
Geoscience
Council

Report Of The 1982 Advisory Committee To The Geological Branch Ministry Of Energy, Mines And Petroleum Resources

Open File 1986–8

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Geological Survey Branch
Mineral Resources Division

By the
Canadian Geoscience Council Advisory Committee to the
British Columbia Geological Branch
Chairman: H.C. Morris
Members: H. Greenwood, G. Mossop, E.R.W. Neale, A.E. Soregaroli

Victoria
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Canada
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Preface

This external review of the Geological Branch was commissioned by the Deputy Minister, Mr. R.A. Illing, in 1981 on the recommendations of the then Deputy Minister, Mr. A. Freyman and Chief Geologist, Dr. A. Sutherland Brown. The review was undertaken in the fall and winter of 1981 and was finalized in 1982. The report captures the status of the Branch in 1981, a time of some disarray due to the exodus of many professional staff to an expanding local mining industry.

The terms of reference required the Committee, drawn from industry, government and academia, to conduct a wide-ranging overview of all aspects of the Branch, including the question of its continued existence.

The insights and recommendations in the report have been widely used by Dr. W.R. Smyth, the new Chief Geologist, and the new management team of the Branch in charting initiatives and directions during recent years. In particular, the section "Need for a Geological Branch" helped justify and maintain programs during the restraint evaluation process.

Many of the Committee's recommendations have been implemented by the new management team, for example:

1. The backlog in Branch publications, a major shortcoming, was virtually eliminated in 1985-86.
2. An office was opened in Vancouver in 1986 staffed by a Senior Regional Geologist.
3. A formal planning process has been established, and 1 and 5 year plans have been drawn up for each of the sub-sections.
4. A new Coal Sub-section was created in 1986 to provide a better focus and direction for the Branch's coal program.
5. A plan for replacing obsolete equipment in the analytical laboratory was adopted and in 1986, a new XRF unit was purchased.

However, some of the problems identified still persist. Hence this report is being made available to a wider audience at this time to help focus attention on the outstanding issues and to stimulate a dialogue with all interested parties. The Ministry, the Branch, and the Committee will welcome comments on the conclusions drawn and recommendations made.

It is highly to the credit to the Ministry and the Geological Branch that an independent review was commissioned in 1981. The Branch is to be commended for its interest and participation in the original investigation, for the energy and dedication which they have brought to correcting some of the observed deficiencies, and for publishing the report. It is hoped that release of this summary of the Committee's findings will stimulate on-going discussion with the interested public and enable the Branch to advance with a further round of constructive initiatives.

H.C. Morris, Chairman
Vancouver, November 1986

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Introduction

Composition of the Advisory Committee

The Advisory Committee convened by the Deputy Minister of the Ministry of Energy, Mines and Petroleum Resources, Mr. Illing, is as follows:

Chairman — Dr. Hugh C. Morris, President and Chief Operating Officer, Geomex Minerals Ltd., Calgary.*

Dr. Hugh Greenwood — Head, Department of Geological Sciences, The University of British Columbia, Vancouver.

Dr. A. E. Soregaroli — Vice-President, Explorations, Westmin Resources Ltd., Vancouver.

Dr. Grant Mossop, Head, Alberta Geological Survey, Alberta Research Council, Edmonton.

Dr. Ward Neale, Sr. Scientist, Institute of Sedimentary and Petroleum Geology, Geological Survey of Canada, Calgary.**

*Presently: Chairman and CEO, Imperial Metals Corporation, Vancouver, B.C.

**Presently: Vice-President (Academic), Memorial University, St. Johns, Newfoundland.

Activities of the Committee

The initial activity of this committee was an extended briefing provided to it by the management and staff of the Geological Branch in Victoria. This meeting included a session with department managers, a tour of facilities, an overview by Dr. Freyman, the Assistant Deputy Minister and the Chief Geologist, Dr. Sutherland Brown, and a question period. The Committee then held an initial meeting, elected its chairman, and established some rules and procedures for its activities.

The Committee adopted the following overall plan of investigation for its assignment. Selected subdivisions of the Geological Branch were reviewed in detail by individual members of the Committee. Interviews were conducted with a substantial number of senior and junior employees of the Geological Branch and with a number of industry, government, and institutional geologists and executives who have had dealings with the Branch or whose activities parallel it.

The Committee met on several occasions as a group in Vancouver, and additional meetings of subgroups within the Committee were held in Calgary and Vancouver, as convenient, for additional discussions on specific topics.

At the draft stage, a review meeting was conducted with the Chief Geologist, Dr. Sutherland Brown, to provide an opportunity for further input and representation by the Geological Branch.

Acknowledgments

The Committee wishes to record its sincere appreciation for the truly outstanding cooperation they have received from all members of the Geological Branch. Their frankness and interest are gratefully acknowledged.

The Committee must also record its gratitude to the many persons in the mineral community who responded so readily to the enquiries made of them. Their responses were a major contribution to the work of the Committee, and their interest in the Geological Branch and its activities augers well for its future.

The Committee compliments the Ministry and the management of the Geological Branch on their decision to invite outside review. This is a progressive and wise action which will prove to be constructive and rewarding.

Terms of Reference

Mandate

The mandate of the Advisory Committee to the Geological Branch was set forth by the Ministry of Energy, Mines and Petroleum Resources as follows:

(1) To review and report on the need for a Geological Branch and, if there is a positive need, to recommend the level and direction of effort.

(2) To review and report on the present and desired relationship with the respective components of the minerals sector (exploration, mining, processing), with universities and research institutes, and with branches of government (British Columbia, other provinces, federal).

(3) To review and report on the goals, objectives, organizations, operations, management, and effectiveness of the Geological Branch.

Need for a Geological Branch

General

To properly assess the nature of the need for a Geological Branch in the British Columbia Ministry of Energy, Mines and Petroleum Resources, it is necessary and appropriate to consider the nature of mineral exploration. This will establish the context and setting against which to appraise the function and role of the Geological Branch.

Mineral Exploration

Exploration for naturally occurring mineral resources can be described as a complex problem-solving activity with major components of interpretation and logical analysis. The exploration process requires multistage selections which start with the appraisal and analysis of a large amount of existing data. These data are highly varied. They include scientific information and measurement of geological, geophysical, geochemical, and other parameters; they may include historical records relating to past exploration or exploitation activity; they may also include comparative data derived from parallel situations in similar geological environments from many other regions of Canada or other parts of the world.

This appraisal and analysis stage is normally followed by a data-gathering stage during which new measurements are made and additional information is developed. This in turn leads to an interpretive function which culminates in the definition of a "target".

This target is now tested by one or more of several physical procedures such as sampling or trenching or drilling. The testing process frequently sets up a new cycle of the data-collecting and analysis steps. This cycle may continue for one to several repetitions as the workers attempt to converge on a clear outcome.

The severity and complexity of the difficulties inherent to mineral exploration are borne out by the fact that there are so few successes. When one considers the number of claims, properties, projects, and active field parties in the Province of British Columbia in a single season, and contrasts this to a number of discoveries, a measure is obtained of the degree of difficulty and the probability of failure in the exploration process.

In 1980, 70 000 claims were staked and over $100 million was expended in British Columbia. Over 5 000 man-years of work were conducted. This huge and intense effort resulted in less than 10 significant mineral discoveries, of which less than half will likely attain profitable production in less than 6 years.

A number of studies have been made by both industry and government of the ratio of success to failure, of the probability of success at any stage, etc. One particularly relevant review, by R. A. Spencer of Cominco, calculated that probability of success on any individual property at the time of staking is less than one chance in one thousand. These odds have been supported by other studies, all of which demonstrate that successful mineral exploration is a sophisticated exercise in risk management and problem solving.

One may also consider the exploration process as similar to an applied research undertaking. It calls in most cases for the application of many related and occasionally even unrelated subdisciplines of science and technology such as geophysics, chemistry, satellite imagery, computer technology, etc.

This theoretical framework can be demonstrated for everyday mineral exploration as follows. It starts out with the period of office research and study. This leads to the delineation of a field area in which the exploration process is applied. This exploration process would usually consist of a multi-pronged attack utilizing geological mapping, geochemical and geophysical surveys, prospecting, etc. It culminates in the acquisition of mineral property through staking or leasing, and the definition of targets for drilling. It may require a stage of detailed exploration, of detailed surveying, and of multiple further stages of refining and testing. With encouragement, new factors such as metallurgical recovery, mineral processing technology, marketing, and the economics of exploitation become involved. These will lead to mining studies and feasibility analyses which will finally identify the degree of failure or success in a particular exploration venture.

One clearly emerging and fundamental point is that the total process uses a vast amount of data and a major body of scientific understanding. Both stem from scientific and professional activities in applied science which have taken place over many years and which are continuing. These are mainly conducted by industry, supplemented by research institutions such as the Geological Branch, by other government agencies, and by universities.

The Role of Government

Natural resources in Canada are (at least at present) a provincial responsibility. In every province in Canada, therefore, the provincial administrations have a broad responsibility and accountability for nurturing and fostering the natural resource industries.

The Provincial Government of British Columbia has overall major responsibilities for the generation of provincial wealth from the natural resource base, for the protection of the provincial environment, and for providing opportunity for private enterprise to individual provincial residents. The Geological Branch is in a unique and responsible position relative to these provincial responsibilities in the Mineral Exploration field. No other organization can supply technical leadership in the sense of coordinating and integrating mineral exploration procedures and technologies. No other organization is in the position to supply all embracing service to the smaller private enterprise and to individuals. No other organization is in the position to provide discriminating data for good policy decision-making.

All provincial governments in Canada have recognized that there is a vital need for a combined technological and administrative bureau which addresses itself to the many geological facets of the mineral industry.

The Committee agrees categorically with this position. It is clearly essential to have a Ministry within the Provincial Government which addresses the jurisdiction of resources. For this Ministry to function adequately and creatively, it is necessary to have a geologically oriented organization which can administer many of the technological aspects of resource management, and which can provide up-to-the-minute data to provide a base for enlightened and progressive decision-making by the Ministry.

Level of Effort

The task of estimating a desirable level of effort, and of its associated expenditure, is complex. In an era of inflated government spending, there are many urgent reasons for recommending economies and cost reductions by the administration. Furthermore, governmental monitoring and regulating bodies represent a form of "overhead" which is levied in one way or another on the provincial wealth. It is only too easy for such overhead functions to become self-perpetuating and unessential consumers of public tax monies.

However, just as it is proper for government to exercise due concern and prudence with public funds, so it is incumbent on them to make judicious and timely investment of these revenues into areas and activities where the private sector is not able to function effectively. The process of regulating, monitoring, and stimulating the minerals sector is clearly one of these.

Even given this position and conclusion, it is no easy

matter to select and recommend a specific financial level. The committee feels that it is not able to specify budget levels, etc., given the limited time at its disposal. Instead, it proposes to consider certain relevant factors and to conclude and recommend in general terms only.

The level of effort may be analysed by the following three comparisons:

(i) Comparison of mineral industry with other resource industries,

(ii) Comparison with similar provincial expenditures in Canada,

(iii) Comparison of British Columbia mineral industry with the United States of America.

(i) Mineral Industry Compared to Other Resource Industries

One method of approaching the question of how much money should be invested by government in the geological characterization of mineral deposits is to relate the governmental investment to the value of the minerals industry in the province. Table 1 sets out the dollar value production figures for materials mined in British Columbia over the five years 1976 to 1980. The mined resources include metallic minerals, nonmetallic minerals, structural materials (aggregate, lime, clay products, etc.) and coal, all of which fall under the purview of the Geological Branch. As the table indicates, the total value of production from British Columbia mines over these years is in excess of $8.2 billion. The mining industry is clearly a major contributor to the economic health of British Columbia.

How does the mining industry compare in size to other resource industries? Table 2 compares the dollar value of mining production with that of petroleum production over the same period. The figures indicate that the production value of crude oil, natural gas, and natural gas byproducts is in the order of $2.4 billion over five years. Of the total value of production from geological resources in British Columbia over the past five years ($10.7 billion), 77 per cent is from the mining sector (Table 2).

The only resource industry that surpasses mining in terms of economic impact in British Columbia is the forest industry.

TABLE 1

DOLLAR VALUE OF MINERAL PRODUCTION
BRITISH COLUMBIA[1,2]

	1976	1977	1979	1979	1980
METALS	698 425 822	781 556 843	868 319 276	1 367 866 248	1 465 617 000
NONMETALS	54 756 979	81 603 650	61 420 237	85 931 558	115 127 000
STRUCTURAL MATERIALS[3]	105 303 164	119 463 016	143 402 199	185 192 766	247 040 000
COAL	297 756 900	294 954 000	374 467 000	488 135 000	445 430 000
TOTALS	1 156 242 865	1 277 577 509	1 447 608 712	2 127 125 572	2 273 214 000

5-YEAR TOTAL 8 281 768 658

[1]Source - Canadian Mining Journal 1978, 1979, 1980, 1981.

[2]Includes all earth resources produced by mining (i.e. the so called "hard minerals"), Government geological responsibility for which rest with Geological Branch, Mineral Resources Division.

[3]Includes sand and gravel, stone, lime, clay products, and cement.

TABLE 2

DOLLAR VALUE OF BRITISH COLUMBIA
MINING AND PETROLEUM PRODUCTION[1]

	1976	1977	1978	1979	1980	5-YEAR TOTAL
MINING[2]	1 156 242 865	1 277 577 509	1 447 608 712	2 127 125 572	2 273 214 000	8 281 768 658
PETROLEUM[3]	489 957 000	408 933 000	435 043 000	549 611 000	522 124 000	2 405 668 000

TOTAL VALUE OF PRODUCTION FROM GEOLOGICAL RESOURCES 10 687 436 658

PERCENTAGE OF TOTAL PRODUCTION VALUE

MINING $8\ 282 \times 10^6 / 10\ 687 \times 10^6 = 77\%$

PETROLEUM $2\ 406 \times 10^6 / 10\ 687 \times 10^6 = 23\%$

[1]Source - Canadian Mining Journal, 1978, 1979, 1980, 1981.

[2]Includes metals, nonmetals, structural materials, and coal (i.e. "hard minerals").

[3]Includes crude oil, natural gas, and natural gas by-products (i.e. petroleum resources).

TABLE 3

COMPARISON OF BRITISH COLUMBIA MINING INDUSTRY AND BRITISH COLUMBIA FOREST INDUSTRY

[All values shown in millions of dollars ($ × 10^6)]

		1976	1977	1978	1979	1980	5-YEAR TOTAL
MINING INDUSTRY	$ Value of production[1]	1 156	1 278	1 448	2 127	2 273	8 282
	$ Revenue to B.C. Treasury[2]	61	35	42	69	119	326
	$ Expenditure by B.C. Treasury[2]	5	6	6	7	8	32
	B.C. Government reinvestment in mining industry, relative to production value = 32/8 260 = 0.4%						
FOREST INDUSTRY	$ Value of production[3]	3 220	3 776	4 618	5 693	5 652	22 959
	$ Revenue to B.C. Treasury[4]	86	145	298	609	401	1 539
	$ Expenditure by B.C. Treasury[4]	85	98	132	244	405	964
	B.C. Government reinvestment in forest industry, relative to production value = 964/22 959 = 4.2%						

[1]Source - Canadian Mining Journal 1978, 1979, 1980, 1981 (*see* Table 1).

[2]Source - Financial and Economic Review, B.C. Ministry of Finance.
Includes all mining related revenues (expenditures) by B.C. Treasury

[3]Source - B.C. Council of Forest Industries.
Includes all crude and fabricated forest materials.

[4]Source - Financial and Economic Review, B.C. Ministry of Finance.
Includes logging tax, stumpage, timber sales, and other lands and forests revenues (expenditures).

As Table 3 shows, the value of forest production over the five years 1976 to 1980 comes to $22.9 billion, over 2.5 times the production value from mining.

It is constructive to compare the amount of money which the British Columbia government reinvests in these two major resource industries. In the forest area, British Columbia Treasury has invested $964 million over the past five years (Table 3). In relation to the total value of production ($22.9 billion) the 964 million represents a governmental reinvestment in the resource of some 4.2 per cent (Table 3). The equivalent figures in mining (8.2 billion production, 32 million invested) show that the total governmental reinvestment in the mining industry comes to only 0.4 per cent. Even acknowledging that the two industries are very different and that they place different demands on the government, it is difficult to understand how, in relation to the economic value of the respective resources, the mining industry warrants only one-tenth the government support that the forest industry receives.

(ii) Comparison With Other Provincial Ministries

Deductions from the preceding considerations relate primarily to the level of budgetary expenditure which might be considered appropriate in the Mineral Resources Division of the Ministry. In like fashion, a second comparison can be used to make a comment on the level of effort which may be

TABLE 4

GOVERNMENTAL EXPENDITURE ON THE GEOLOGICAL CHARACTERIZATION OF HARD MINERAL RESOURCES[1]
1980

PROVINCE	VALUE OF MINERAL PRODUCTION[2] $	GEOLOGICAL SURVEY (BRANCH) EXPENDITURE[3] $	RATIO OF EXPENDITURE/ VALUE	MULTIPLE OF B.C. RATIO (EXPENDITURE/ VALUE)
BRITISH COLUMBIA	2 251 143 000	3 019 000	0.134%	1.0
ONTARIO	4 625 637 000	10 732 000	0.232%	1.7 ×
QUEBEC	2 501 085 000	13 610 000	0.544%	4.0 ×
NEW BRUNSWICK	402 220 000	3 612 000	0.898%	6.7 ×
NEWFOUNDLAND	1 083 319 000	3 484 000	0.322%	2.4 ×

[1]Includes metallic minerals, nonmetallic minerals, structural materials, and coal.

[2]Source - Canadian Mining Journal, February, 1981.

[3]Source - Committee of Provincial Geologists, Report to Mines Ministers, October 1981.
Includes expenditure related to the study of mineable resources only (i.e. exclusive of expenditures on petroleum resource studies).

appropriate in the strict geological characterization of mineral resources (as opposed to expenditure in titles, inspections, etc.). This, then, relates more specifically to the Geological Branch per se.

Table 4 sets out expenditure figures for five provincial geological surveys across the country and relates these expenditures to the total value of mineral production in each province. As the table shows, all provinces devote less than 1 per cent of the total value of mineral production to geological characterization of the mineral terrains. British Columbia is the lowest, however, at 0.134 per cent (Table 4). Indeed, in relation to the value of mineral production, the two other major producers, Ontario and Quebec, respectively spend 1.7 times and 4 times more money on basic geological work than does British Columbia. Even small provinces in Canada spend considerably more than British Columbia (New Brunswick, 6.7 times as much; Newfoundland 2.4, times as much).

The conclusion to be drawn from these figures is that other provinces recognize a much more important role for government geological survey work in minerals than does British Columbia. For British Columbia to bring itself more or less into line with other jurisdictions in Canada, it would have to more than double the level of expenditure on the Geological Branch.

In fairness, it should be pointed out that the figures contained in Table 4 do not constitute an infallible analysis of the situation. The Geological Survey of Canada undertakes geological mapping in British Columbia, and this is not reflected in the Table 4 figures. Whether this is proportionally more in British Columbia than in some of the other tabulated provinces has not been determined. Nonetheless, the Advisory Committee believes that, in the context of what other provincial governments are doing, British Columbia's support of basic geological mapping, research, and service work is much below the level that it should be.

(iii) Comparison with Equivalent Areas of the United States of America

It is instructive to compare the mineral industry of British Columbia, and its contribution to the provincial wealth, with the equivalent industries in the United States. In general, the mineral sector of the western United States is 25 to 50 years further advanced than that of British Columbia. This has been caused by a number of factors, including the earlier settlement of the western States. Easier transportation and climate have assisted the development, together with a larger human resource and capital base. Nonfuel mineral production values from a number of the western states of the United States are tabulated in Table 5. The states selected have similar geological and resource characteristics to the Province of British Columbia. The gross value per square mile of mineral production in this portion of the United States is 87 per cent higher than in British Columbia and is in fact higher in 7 of the 11 individual states.

This value points to a substantial continuing growth for the mineral industry of British Columbia. Equally important, this growth will enlarge the mineral industry's financial contribution to provincial wealth when contrasted with that of the forest industry. In recent years, the forest industry sector

TABLE 5

U.S. MINERAL STATISTICS – 1979

Value of Nonfuel minerals produced in 11 western States whose combined resource potential is comparable to that of British Columbia in terms of overall geology.

State	Value of Production U.S. $ × 1000	Area Sq. Mi.	$/ Sq. Mi.
Arizona	2 490 481	113 909	21 864
California	1 769 675	158 693	11 152
Colorado	826 098	104 247	7 924
Idaho	437 885	83 557	5 240
Montana	291 287	147 138	1 980
Nevada	238 150	110 540	2 154
New Mexico	694 448	121 666	5 708
Oregon	165 207	96 981	1 703
Utah	753 384	84 916	8 872
Washington	224 948	68 192	3 299
Wyoming	590 176	97 914	6 027
Total	8 481 739	1 187 753	
Average	771 067	107 978	7 141
Province of British Columbia	1 393 142	366 255	3 804

appears to have stabilized at or around its present level (calculated in constant dollars).

The large and growing significance of the British Columbia mineral industry demands that the provincial administration pay careful attention to nurturing this growth and to regulating it in a creative and effective manner. It is not unreasonable to argue that there is a need for a greater proportionate investment in coordination and leadership activities at the youthful stage, than during the more mature stages, which are exemplified by the mineral industries of Ontario, Quebec, and other provinces.

Conclusions

(a) Need for a Geological Branch

With regard for the need for a Geological Branch in the Ministry of Energy, Mines and Petroleum Resources, the Advisory Committee must conclude as follows:

The Geological Branch provides the only method by which the large amount of data and enterprise can be monitored with understanding, and made universally available to all provincial citizens. Otherwise, it would remain the private property of the instigator of the work.

The Geological Branch is the only organization in a position to collect, collate, store, interpret, and act as the custodian of these data and to be the clearing house of the applied science expertise and technology which has been utilized or developed for these purposes.

The Geological Branch is the only organization specifically conducting sharply focussed applied research in the earth sciences in a fashion that will enhance, integrate, and link the various activities proceeding independently in mineral exploration and exploitation.

The interaction of these items lead the Committee to the firm conclusion that a single consolidated organization is by far the most effective way to operate. Fragmentation of the

duties of the Geological Branch is certain to be counterproductive. Therefore, it is specifically concluded that:

(i) There is a vital and continuing need for a bureau which provides governmental service and support to the mineral exploration activity of the Natural Resource Sector. The Geological Branch already fills this role.

(ii) The Geological Branch is absolutely necessary in order to provide government with data of high quality and relevance for use in the formulation of effective and appropriate policy.

(b) Level of Expenditure

The provincial budget for the Geological Branch is low when viewed from almost every perspective. This includes comparisons to other industrial segments of the British Columbia economy, comparisons to similar departments of like ministries in other provinces in Canada, with consideration of the overall youthfulness and future potential of the British Columbia minerals sector.

Decisions concerning the level of funding for the Geological Branch must take into account the growing importance of the mineral industry, and the need for leadership and foresight in the administration and management of the resource responsibilities of the Province.

Recommendations

The Committee recommends that Geological Branch expenditures be increased to roughly double the present level. This will bring the British Columbia expenditure more in line with similar government functions in other provinces, although it will still be lower than most. In light of the youthfulness of the mineral sector, this should be regarded as a minimum increase.

Direction and Management

General

The Geological Branch has inherited a long tradition of conscientious and effective public service to the citizens of British Columbia, and in particular to the mineral industry. During the simpler, earlier stages of the exploration and mining industries in the Province, the prime needs were at a working level. As a result, the Branch established excellent working relationships with the mineral industry, particularly in the areas of technical research and coordination. The Branch was instrumental in the supply of a notable series of maps and reports on economically significant mining areas. The Branch also established a series of valued support facilities, including the analytical laboratory and its advisory services to prospectors and assayers. More recently the pressures of ever increasing complexity in the mineral industry and its utilization of the surface and buried resources of the Province have lead the Branch into new areas of resource data analysis and the establishment of decentralized regional representation. However, these functions are still inadequately staffed.

Throughout the discussions in which the Committee has participated, whether with members of the Branch, with associated officers of the civil service, or with a diversity of individuals in industry and other institutions there has been a common thread. All parties feel that the Geological Branch should move to a more aggressive and articulate posture. The Committee fully supports this view. Within the constraints of the time available for its meetings and studies, it is difficult for the Committee to develop a detailed set of recommendations and suggestions for such a new campaign. It is the Committee's opinion that the goals, objectives, policies, and priorities of the Geological Branch, and indeed the mining division, of the Ministry should be re-evaluated and revised. This process should be done thoroughly and preferably in consultation with representatives of all segments of the minerals industry. It should be undertaken as soon as possible.

The Committee has recommended that the activities of the Branch should expand to a level commensurate with the size of the minerals industry and of the Branch's responsibilities to it.

Without attempting to provide a detailed policy directive, the Committee wishes to recommend the following:

Recommendations

(a) Geoscience Projects Section

The technical development and research function carried out by the Geoscience Projects Section is desirable and has demonstrated its value. It should be brought up to strength and maintained.

(b) Applied Geology Section

The applied geology function desperately needs direction and expansion. Decentralized regional representation at an effective level is urgently needed. It is interesting to compare the local and regionial impact of other ministries, such as fisheries, forestry, and environment with the level of representation of this Ministry. There would appear, to the Committee, to be attractive opportunities for combining offices with representatives of the Minerals Titles Division, etc.

(c) Resource Data and Analysis Section

The collection, monitoring, and management of resource data need to be amplified and extended. This activity is far too weak in its present form to have its desirable and needed impact on management and government decisions. In particular the Coal Subsection needs bolstering.

(d) Analytical Laboratory

The analytical laboratory is a required in-house service function, and has several external key duties. It should be maintained, but urgent attention must be given to significant organizational and morale problems which exist. Productivity must be increased.

(e) Management

The "management" of the Geological Branch represented by the Chief Geologist and his section heads, in concert with the Assistant Deputy Minister, must modify its procedures in dealing with senior levels of both the private and public sectors. There is room for improvement in the budgeting and policy and planning processes, and on the level and nature of

input to the top level of the Ministry and to Cabinet. In the private sector, the Branch must participate and take initiatives to seek out responses and collaboration from industry in the formulation of policy both for the Branch and for government.

(f) Publications

A coherent and prompt publication process must be put in place. This is required in order to relay all the various components of the Branch's activities to the public in appropriate form.

(g) Management Training and Support

As is so often the case in research institutions where scientists are thrust into managerial roles, technical competence, respect of staff, experience, and sound managerial instincts can go a long way, but some advanced management training also is highly desirable. Extensively trained and experienced scientists cannot be expected to be outstanding managers if they are not provided with appropriate managerial tools and insights.

(h) Support by Other Civil Service Groups

The level of administrative service provided by the Personnel Branch of the Finance and Administration Division seems to be grossly inadequate. The filling of vacancies is not conducted expeditiously. Classification and reclassification of positions are seen as arbitrary and slow. Staff discontent in these areas is at a high level.

(i) Professional Engineering Status

The requirement that Branch geologists be registered as professional engineers is an outdated and counter-productive stipulation. Steps should be taken to remove this requirement.

(j) Other Activities

A number of Mineral Industry and Earth Science activities are either not being systematically addressed by the Branch at an adequate level, or are ignored for various reasons. Some have been made a part of the responsibility of other segments of the Ministry, but are more naturally extensions of the Geology Branch. They include geothermal energy, industrial and structural materials, surficial mapping, and land use.

(k) Mandate

Most provinces in Canada, indeed most political and geographical jurisdictions in the world, are structured in such a way that a single government body is assigned responsibility for discharging the geological survey function. Such a function, simply stated, involves understanding all aspects of the geology and earth resources within the jurisdiction. There is no arm of the British Columbia government which espouses such a singular mandate. The Geological Branch is restricted to the realm of mineral resources. Consideration perhaps should be given to broadening the mandate of the Geological Branch to include at least some other elements of the geology of the province and some other earth resources. Definition of such a new mandate would have to be considered in light of the way in which the Geological Survey of Canada sees its role in British Columbia. Nonetheless, it is apparent to the Advisory Committee that the British Columbia government should perhaps strive to ensure that it has some in-house competence in all earth resources areas and that geological survey endeavours in these areas should be coordinated.

Relationships between the Geological Branch and Other Sections of the Mineral Industry

The committee conducted several systematic campaigns by interviews and questionnaire to ascertain the impressions and perceptions of outside parties.

The results of these discussions are described below under five categories:

(a) The Private Sector — Industry
(b) Universities
(c) The Geological Survey of Canada
(d) The Geological Surveys of Other Provinces
(e) The British Columbia Government
  (i) within the Ministry
  (ii) outside the Ministry

The Private Sector — Industry

Twenty interviews were held with representatives of various private sector groups. These covered the range from individual prospector to large corporation and from junior professional to senior executive. In addition, the subject was introduced into many other conversations in order to elicit spontaneous responses.

The topic was referred to in all discussions and interviews with the staff of the Geological Branch in order to evaluate the Branch's internal perception of the relationship.

Findings

(a) Communications

Relationships with industry are a direct function of communication and personal interest. Responsibilities for communications lie with both parties and such relationships are highly varied.

At present most communication is accomplished at the field level where one-on-one contact prevails between workers in areas of mutual interest. These associations are considered as excellent and mutually beneficial by all segments of industry that were canvassed.

Of secondary but still major importance, is communication at scientific functions. Personal encounters with Branch personnel at such functions may be the only contact available for many people in industry.

Not enough members of industry travel to Victoria for the purposes of discussions on general projects or to enquire as to the nature of Branch work in general. Telephone communication is the prevailing method of enquiry. Industry visitors only come to Victoria to discuss specific projects where a particular involvement or interest prevails. Most industry representatives are of the opinion that the location of the Geological Branch in Victoria impedes good communication.

Major dismay was expressed about the apparent breakdown in publications. Technical publications and annual reports of activities and reviews of exploration work in the province are highly valued but their value is also dependent on punctuality. The delays currently being experienced are regarded by industry as self-defeating and it is felt that they are unacceptable.

It is clear to the Committee that industry does not properly understand the functions, mandate, or intentions of the Geological Branch. In most cases industry has made little or no attempt to analyse or to form an opinion as to the role of the Branch and its subdivisions. Most have accepted the *status quo*. Much of this attitude is due to misunderstanding and lack of informative communication. Part of the cause is believed to be the geographic separation of industry which generally resides in Vancouver, from the Victoria-based Geological Branch.

(b) Personnel and Organization

As with most complex organizations, outsiders (industry) do not understand the functions and roles of the various subdivisions of the Branch. This is especially obvious in discussions regarding Project Geologists and District Geologists. Confusion exists in the minds of industry personnel as to the role of the District Geologists. This is compounded by the fact that each District Geologist appears to be playing a different role. District Geologists appear to lack overall direction. This is undoubtedly accentuated by the vacancy at the management level in Applied Geology. However, there is some feeling there has never been an effective manager in this position and this lack has permitted deterioration of internal communication, leaving each District Geologist to define his own role according to what he felt he should or would like to accomplish.

Almost all Project Geologists are considered as excellent scientists who are performing well and contributing to the understanding of British Columbia's mineral deposits. The Project Geologists attained a high profile with industry in the past but this has suffered in recent years because of the publications problems. A minor criticism, true of most civil service as well as some industrial groups, is that non-producers can lose themselves in the system and remain there unmolested without significant contribution.

(c) Programs

The areal studies of mineral-bearing terrains cover a very important facet of exploration that cannot be tackled by any other group. These studies transect property boundaries, integrate data, and provide the framework for better understanding of crucial areas and can aid in the design of better exploration programs. Confidentiality is required of much data obtained from specific privately owned properties and, with only one exception, all industry representatives felt this had presented no problems. The only case cited as a breach involved a young geologist who may not have been well aware of the nature and need of confidentiality.

The areal studies are considered by industry as one of the most important roles of the Geological Branch, along with the collection of data on mineral showings and exploration activity. The quality and timing of these studies were traditionally excellent, but the importance and prestige of these projects have suffered in recent years partly due to the time lag for publication. There are few complaints in regards to the quality of work. A few studies were questioned as having little significance to mineral exploration or to the understanding of mineral deposits. Such comments are regarded by the Committee as no more than professional differences of opinion.

A more frequent comment concerned the apparent absence of work in areas which industry regards as needing study and attention. Related to this were several questions about priorities in selecting work programs.

Industry has no concept of how projects are generated, selected, or controlled and many were surprised to consider the possibility that they might perhaps contribute suggestions for projects. There is a prevailing perception that such input may not be well received by senior management of the Geological Branch.

Most industry representatives would like to see a larger number of areal studies by the Branch.

It must be noted that industry professionals, particularly at senior levels, also add to the communication problem through their own lack of initiative.

(d) Management

Three levels of management were addressed in interviews with industry: (a) Ministry, (b) Branch, and (c) Section.

Few industry representatives could identify responsible people at the Division level. Few could identify Mr. Illing as Deputy Minister of Energy, Mines and Petroleum Resources, except those involved in groups such as the British Columbia and Yukon Chamber of Mines. Most were familiar with the name and position of Mr. McClelland. The widespread opinion is that the importance of the mineral industry is not recognized within the Ministry and is thus not being conveyed to the Cabinet or to the general public.

At the Branch level, industry feels concern over the large number of resignations in recent years. Industrial people prefer not to comment on the reasons for such resignations but are concerned that many positions have been neither advertised nor filled internally. The Chief Geologist is considered as amiable, but perhaps somewhat aloof in his associations with industry.

Management at the section level is generally perceived as adequate to good. The Project Geology Section is considered as well managed. Some concern has been expressed regarding the Resource Data Section, but most industry representatives feel this may be because the section head is not yet well known to them.

The lack of appointment of a section head in the Applied Geology Section for such a long period of time is of great concern to industry. Industry feels the role and performance of this section have suffered badly because of weak direction in the past coupled with weak direction at present.

Relatively few geologists in the exploration industry are familiar with the Analytical Section or with its head and therefore there was little input on the subject. However, staff of the Analytical Laboratory are much better known to workers in their specialty elsewhere.

(e) Miscellaneous

Almost without exception industry does not know how much budget the Branch receives nor how the budget is

apportioned. The feeling however is that they are underfunded and are forced to depend on partial field support (helicopter, etc.) by industry on their projects; that they generally lack support staff in the field; and that they have little or no technical support staff in Victoria or in the District Offices.

Some members of industry commented on the usefulness and importance of such high profile Co-Operative projects such as the Prospectors' Assistance Program and the support of field projects for university graduate students.

Conclusions

(1) Relationships between the Branch and the Private Industrial Sector are unsatisfactory.
(2) The relationship is good at the scientific working level and is being improved here by well-conceived initiatives by the Branch. These initiatives include the bi-annual "Open House", which is well attended.
(3) Relationships are poor in most areas of policy (understanding and input).
(4) Industry has little understanding of the functions and mandate of the Branch, or of the workings of the Ministry in general and the Branch in particular.

Recommendations

(1) The Geological Branch should take initiatives to improve communication with industry, particularly in nonscientific areas.
(2) One or more working groups or committees should be established to solicit input for policy and planning purposes. These groups should include both the Branch and outside personnel, and should meet and report regularly.
(3) The Branch should expand the volume and range of its "P.R." activities, both to better inform industry and to better ensure effective support from industry, both directly and through endorsement of the Branch's role and activities.
(4) Representation outside Victoria must increase. Regional offices should be increased in number and they must be adequatly staffed and run. An effective and visible Vancouver office should be developed.

Universities

Findings

Five replies were received in response to inquiries which were made to eight institutions which have had dealings with the Branch in recent years. The responding universities were — The University of British Columbia, University of Calgary, University of Alberta, Carleton University, and Queen's University. These replies were very uniform. The general questions asked were:

(1) What kinds of dealings have you and your colleagues had with the Geological Branch (research grants, contracts, consulting, use of maps and reports, consultation with personnel);
(2) In each of these areas please comment on (a) quality of map, report, etc., where applicable; (b) effectiveness of the Branch in providing service; (c) effectiveness of any arrangements, including financial ones, in achieving goals either of your own or of the Ministry; (d) effectiveness and competence of any personnel you have dealt with.

The replies may be summarized as follows:

(1) Dealings between university personnel and the Ministry have all been related to support for research. The Branch has for years given partial support for field and other research directly related to ore deposits. Projects are invariably selected and started on a one-to-one basis with extensive discussion. The decisions rendered by the Ministry are uniformly considered to be fair and open and consistent with the goals of the Geological Branch. Most dealings occur initially between the University and the Chief Geologist and subsequently with members of the Project Geology Section.
(2) All respondents rated the publications of the Geological Branch as outstanding. One respondent stated that the preliminary map series is prepared with too much attention to detail, suggesting that it could be done in less meticulous fashion and be produced more quickly.
(3) Delays in publication have become extreme and it is now impossible to know if or when work will appear, regardless of when it was completed. This is regarded by all respondents as a major problem.
(4) As most of the interaction between university personnel and the Geological Branch revolves around research support, it is not surprising that the size of amounts awarded came in for constant mention. Three respondents suggested that a figure of $10,000 would be appropriate for one student, an assistant, and a summer of work followed by a winter of analysis and writing, whereas a typical grant is somewhere between $3,000 and $5,000. This is regarded as inadequate, and it was felt in many quarters that the Geological Branch, by offering such low support, is receiving more than it pays for.
(5) Personnel of the Geological Branch received repeated compliments. Regarded as being highly competent and helpful, they are seen as a first class group of earth scientists working in a most effective way.

Suggestions Made By Respondents for Improvement

(1) The Geological Branch appears to lack long-term goals and objectives for its field projects. It seems appropriate that the Branch should lead the mineral industry rather than following it from prospect to prospect.
(2) Interaction with the Geological Survey of Canada and the Universities — recommendations:
    (a) A program involving major cooperative projects with joint funding and joint participation between personnel of the Branch, the Geological Survey of Canada, and the universities should be instituted. This would ensure the production of high-quality work, mutual cooperation, and improved communications between all three groups.
    (b) Annual seminars between participating members of the universities, the Branch, and the Geological Survey of Canada would also improve communication.
    (c) The publication backlog is a major problem. It must be cleared and turnaround time reduced.

In summary, it is clear that the University personnel have high regard for the Branch's scientific personnel and for the quality of their work. The principal complaints involve the

slow rates of publication, and the modest level of support for research sponsored by the Branch. If these could be remedied and some major cooperative projects initiated, then the university personnel would feel that the Ministry fully meets its objectives.

Conclusions

(1) Scientific relationships between the Branch and Universities have traditionally been good, with high mutual esteem.
(2) Research funding by the Branch has been valuable and productive, but is probably subdivided into allotments of inadquate size. However, few academics understand that it represents a subtraction from the Branch's own allotment.
(3) Delays in publication have become a major irritant and disincentive to cooperation.

Recommendations

(1) The publication procedure must be drastically revised to provide for effective release of Branch and Branch-supported work within a reasonable time frame.
(2) The Branch should maintain a modest but workable program of support for university research. The studies should conform to Branch policies. The programs and results should be systematically reviewed and released.

Geological Survey of Canada

Findings

(a) Areas of Responsibility

The Geological Survey of Canada (GSC) has had a place in the geological appraisal of British Columbia's resources since that Province's entry into Confederation. Its mandate was broadly spelled out at an early date. However, in recent years, the division of labour between GSC and Geological Branch has been maintained by informal mutual agreement. The GSC devotes itself chiefly to regional studies (onshore and offshore) that are not necessarily confined within provincial boundaries. Where these involve mapping, the scale is usually 1:250 000. The Geological Branch, in contrast, has a regulatory and advisory function and its research activities are problem oriented. These latter are conducted chiefly in areas of mineral or coal potential and when mapping is involved it is generally at 1:50 000 or more detailed scale.

(b) Cooperation and Exchanges

In past years, the Director of the Cordilleran Division of GSC has visited the Geological Branch annually to advise Branch scientists of GSC plans and to inform himself of projected Branch studies. In 1981 in a meeting at Victoria, this exchange was expanded to include several directors and other senior officers of GSC. In 1982, a similar gathering of research managers and senior scientists is scheduled to take place in the GSC's Vancouver office. To quote managers of both organizations: "The relationship has always been good and is getting better". The regional studies of GSC complement those of the Geological Branch so that there is no overlap or duplication of effort. Information sharing is generally at an exemplary level although field cooperation and joint projects are relatively rare — usually taking the form of co-authored publications when one party calls on information gathered by another.

The Uranium Reconnaissance Program was promoted by the Geological Branch, which urged its continuation. The Branch's regional geochemical surveys call upon the GSC for assistance with data handling. A computerized coal data file was constructed under contract jointly with GSC, and the Branch is supplying raw data to GSC officers concerned with modelling structurally complex coal basins. Officers of the Branch's Analytical Laboratory have cooperated with GSC on several studies and the Laboratory manager has published a widely recognized textbook on rock analysis in co-authorship with a GSC counterpart. The only hint of friction reported concerns a certain Branch sensitivity to field studies of British Columbia mineral deposits by scientists of the Mineral Resources Division of GSC. Some Branch people feel that such studies, although part of larger national programs, overlap on their domains.

(c) Comments and Views of GSC Scientists

Nine scientists of the GSC's Vancouver office were interviewed, including both senior and relatively junior members of the Cordilleran and Terrane Sciences Divisions. Three scientists from the GSC Calgary office were interviewed, chiefly in regard to coal and some other aspects of applied geology. Phone conversations with Ottawa-based GSC personnel checked on viewpoints concerning mineral deposits and geochemistry. In all cases, the feeling came through strongly that roles were complementary, cooperation was good in the few areas where it was feasible, and that amicable relationships had long prevailed at both management and working levels. Most of those interviewed made the first three points listed below, the remainder were endorsed by three or more respondents:

(1) Most of the major works published by the Geological Branch are first rate — some are classics in their fields. They are chiefly descriptive, containing less conceptual contributions than some GSC reports, but this is expected in view of the pragmatic goals of the studies.
(2) The Geological Branch is shamefully understaffed and underfunded and, in the opinion of senior GSC people, this has always been the case. The importance of government's role in mineral exploration, development, and conservation has never been appreciated in British Columbia.
(3) At least some, and possibly all, of the blame for continued undernourishment of the Branch must be attributed to lack of understanding in top levels of the Ministry.
(4) The Branch contains some first rate geologists but they don't seem to get the national or international recognition that their quality deserves. Various reasons were given: too few publications in the scientific journals, insular location, descriptive nature of their major works, etc.
(5) Victoria location is a serious disadvantage — it deters the mining exploration people. The Project Geology group, at least, should be located in Vancouver — preferably in the same building as GSC.
(6) Track record of management leaves something to be desired. Over the years GSC people have heard complaints about paternalism, authoritarianism, squabbles

over promotions, and other items generally suggestive of a lack of the communication and delegation required in a largely professional agency.

(7) The Branch's annual publication *"Geological Fieldwork"* should be upgraded. Authors tend to neglect its importance in view of the apparently insurmountable delays suffered by their other publications. They must be practical and seize the only route open to them to get their results out quickly to industry.

(8) The Pleistocene geologists in the Terrane Studies Branch of the Ministry of Environment should be transferred to the Geological Branch. These scientists are presently hamstrung in their soil science environment, producing maps with complex "cook-book" legends that are not meeting favour with potential users. In the Geological Branch they could produce very important work in cooperation with project geologists, land use mappers, and industrial mineral experts.

(9) Activities in coal geology are minimal — the Branch is barely able to keep up with data compilation and storage. They must attract (and keep) some first rate scientists capable of analysing and interpreting data, or government will find it is incapble of formulating intelligent policies and regulations in this increasingly important industry.

(10) The requirements of the Professional Engineer is totally irrelevant to almost all functions in the Geological Branch. It has hampered the Branch in recruiting and retaining top people in several sectors.

Conclusions

(1) Relationships between the Branch and the GSC are good. Continued support should be given to the joint activities involved.

(2) Future clarification of the respective roles of the organizations will be needed in a number of areas. Topics such as Land Use surveys, quaternary mapping, and offshore submarine geology are potential areas for disagreement unless mutually and harmoniously resolved.

(3) Informal opinion by GSC staff concerning the Branch is similar to that of other "outside" groups.

Recommendations

(1) The desired role for the Geological Branch *vis-a-vis* the GSC should be considered in the context of the Committee's recommendation for overall policy review.

Provincial Geological Surveys

Findings

On the formal level, relations between the Geological Branch and the geological surveys of other provinces in Canada are generally amicable and productive. This is largely due to the fact that the Chief Geologist, Dr. A. Sutherland Brown, has a high profile in a number of national geoscience forums — particularly the Standing Committee of Provincial Geologists and the National Geological Surveys Committee, both of which contain representation from the chief geologists of all provinces. The trademark of Dr. Sutherland Brown's contributions to each of these committees has centred around the fostering of scientific cooperation between provinces and the establishment of national standards in applicable areas of common geological survey endeavour. Less directly related to inter-provincial relations, but nonetheless affording significant impact on the operations of provincial surveys across the country, has been Dr. Sutherland Brown's praiseworthy contributions to national and international geoscience societies and related institutions. Examples include the Geological Association of Canada, the Canadian Geoscience Council, the British Columbia and Yukon Chamber of Mines, and the Northwest Mining Association (centred in the northwestern United States). It is difficult to imagine how these types of outreach and liaison activities could be improved.

On the informal level, contact between Geological Branch staff and geologists in other provincial geological surveys appears to be slight, restricted to personal contact between certain individuals, often on the basis of involvement in national and international societies. With the exception of certain initiatives from staff in the Resource Data Section, Geological Branch personnel do not appear to devote much effort to determining the methods and approaches used by their peers in adjacent jurisdictions or in equivalent missions elsewhere in the country. In terms of scientific findings, Branch staff are generally aware of the progress being made in other provincial geological surveys.

On balance, it can be said that there is satisfactory scientific contact between Branch staff and geologists in other provincial geological surveys, but that some further effort should be undertaken by Branch staff to make sure that they keep abreast of the new initiatives taken and the innovative techniques employed in other surveys.

Conclusions

(1) Relationships between the Branch and other provincial surveys are good.

(2) There appears to be some scope for expansion of the level of scientific awareness and interchange. Possibly the Geological Branch can suggest initiatives in this area, capitalizing on the established prestige of the Chief Geologist.

The British Columbia Government

Within the Ministry

Findings

(a) Technical Staff

The only other geologists working within the Ministry of Energy, Mines and Petroleum Resources are those in the Geological Branch of the Petroleum Resources Division. That there is practically no contact between the two groups is readily apparent from the fact that Mines Branch staff do not know the names of the individuals involved on the petroleum side and are aware of the petroleum geologists' work only enough to be assured that their own interests do not significantly overlap. It has also come to the attention of the Advisory Committee that the petroleum geologists consider the geologists in the Mines Branch to be somewhat elitist in

their attitudes and perhaps overly academic in their research pursuits. It is the Advisory Committee's feeling that an effort should be made to bring the mines geologists and the petroleum geologists into closer personal and professional contact with one another, thereby, if nothing else, better to foster the exchange of ideas and the sharing of diverse perspectives. The Advisory Committee has not investigated the practicality of physically locating the petroleum geologists in the same or adjacent facilities, or the advisability of perhaps reorganizing the Ministry such that the two groups would come under the same functional control.

(b) **Management**

The Committee did not receive any impression that the various segments of the Mineral Resources Division operated as portions of a closely knit, cohesive unit. It is clear that good communication exists at the level of Branch Head. However, below that, evidence of integrated activity is sparse.

The Committee is not in a position to comment on the present state or on the need to change. It can merely recommend that the Assistant Deputy Minister address the question after the receipt of reports from the separate Advisory Committees.

Outside the Ministry

Findings

Limited discussions were held between members of the Advisory Committee and senior personnel in other areas of the provincial administration. Some difficulties were encountered in obtaining frank input and the committee was unable to find a suitable form for in-depth discussion. The comments below are derived from the limited number of discussions that took place, together with interpretation of the remarks made by the employees of the Geological Branch themselves.

External attitudes to the Geological Branch vary from disinterested to somewhat ill-informed. The branch is perceived, it seems, as a somewhat academic activity in the project areas, and a rather mundane "bookkeeping" type of resource data activity in its monitoring and data collection functions. Little contact of a systematic nature appears to take place other than that required by overall government functions such as budgeting and personnel activity. It is clear to the committee that there is little organized interaction outside these requirements.

Employees of the Geological Branch express a number of frustrations and opinions relative to their dealings with external branches. The majority of these revolve around dealings of the budgetary or personnel administration nature. A second group concerns the service functions of certain government organizations in the area of computing and publication.

The prevailing opinion within the Geological Branch is that the Treasury Board staff have little understanding of either the significance of the mineral industry or of the value of work carried out by the Geological Branch. Some feel that no effort is made by external senior personnel to develop an understanding of the Branch functions. Personnel administration, particularly in areas of job classification and recruiting, is almost universally criticized. There appear to be numerous delays and highly bureaucratic methods involved in this area. It is not possible for the committee to appraise whether this is normal for the provincial government personnel administration or whether a unique situation exists regarding the Geological Branch.

In either case, the situation leaves much to be desired, and the Committee can only urge that pressure be exerted in some fashion to alleviate the problem.

Support from the centralized computing services function of the British Columbia Government is strongly criticized. It is felt to be poorly accessible to ordinary users, ill conceived in its suitability for the needs of scientific workers such as those in the Geological Branch, and hopelessly inflexible and bureaucratic in its attitude toward innovation. There is a general feeling that the computer services group are operating several years behind current requirements and technology, as evidenced by their perceived desire to centralize computing operations and not decentralize them through the use of mini computers, etc. The needs of specialized users such as scientists are felt to receive little attention, possibly because of the overwhelming load of administrative, accounting, and personnel work undertaken by the computing operation.

Support from the publications system of the provincial government is felt to be extremely poor. This topic is totally unsatisfactory in all aspects, and is addressed in more detail elsewhere in this report.

The comments (and complaints) tend to be generalized, and nonspecific. To a large extent they are based on a perceived lack of impact and attention in the communications between the Geological Branch and the Mines Division on one hand and external bureaucracies on the other.

This lack of attention is resented philosophically on the basis that the Minerals Sector is the second largest industrial activity in the province, yet those government departments dealing with it give little or no explicit attention and support. This has been accentuated by statements by the Minister and Deputy Minister referring to the Ministry as a "Ministry of Energy", notwithstanding the fact that the minerals portion dominates both petroleum and other energy resources.

Although the Committee shares the opinion that the perceptions held by outsiders appear to be unwarranted and reflect inattention, some part of the problem clearly lies within the Ministry, and within the Geological Branch.

Traditionally, management level staff of the Branch including the Assistant Deputy Minister seem to have avoided an aggressively active role in carrying their case to the decision makers in Government. The Committee has the impression that Branch representations to the Treasury Board and Cabinet do not have much impact.

It is difficult to avoid the impression that the Geological Branch and Mineral Resources Division have not utilized all available resources to argue their case and achieve their own ends.

Conclusions

(1) It is concluded that communication between the Geological Branch (and probably the Mineral Resources Division) and external departments of the provincial government are less than satisfactory. This has resulted in lower morale within the Geological Branch, in a lack of

understanding of the activities of the Branch (and the Division) on the part of influential government departments and also of Cabinet, and has contributed in a more distant way to an apparent lack of understanding on the part of Cabinet and senior government officials of the significance and value of the minerals sector to the British Columbia economy.

(2) It is concluded that the responsibility for the poor state of this communication lies with both parties, the Geological Branch and the external bureaus. The Geological Branch has been inhibited by past policy and history and has not taken appropriate initiatives in its external communications.

Recomendations

A. The Committee must recommend action on this matter. Out of its concern for the mineral industry of British Columbia, and because of the need for an effective articulate Ministry to both handle the government obligations and at the same time to ensure certain aspects of industry representation. A significant effort must be made by the management of the Branch and Mineral Resources Division to improve the status and impact of their activities.

B. It is beyond the current terms of reference or capacity of the Committee to detail this recommendation. Some suggestions include:

(a) The establishment of a working group to make proper representations and recommendations to both the Ministry of Energy, Mines and Petroleum Resources, and to other government branches.

(b) The striking of a committee specifically designed to brief industry and thus generate a lobby effect.

(c) The inauguration of systematic briefing sessions for other sectors of the provincial government.

In making these recommendations, the Committee urges one caution. The extra work and energy required to achieve improvement in this aspect should not occur at the expense of the scientific and technical levels which have been attained in the past. Nor should it be at the expense of the urgently needed expansions into other technological and monitoring activities which are also required. The need for better political pressure and influence should be regarded as a vital addition to the activities of the Branch and of the Mineral Resources Division and should be so budgeted and administered.

Other Issues

Potential Activities

There are several activities in the mineral resource and mineral industry jurisdictions which are, as yet, not reviewed in depth by the Geological Branch. Several of these warrant attention and are commented upon in this report. It is not clear which section within the Geological Branch should address each problem, nor is it the intention of the Committee to resolve this.

Industrial and Structural Materials

A general shortage of construction aggregate is common in most urban regions of North America and the Vancouver and Victoria areas are no exceptions. Sand and gravel is presently imported from the United States. A number of problems confront the industry: the large number of government agencies, each with differing rules that regulate it (for example three different sets of rules can apply to three adjacent gravel pits); the complex tax structure; and the lack of knowledge of the areal extent of deposits (adequate surficial geology maps are almost nonexistent).

The geological aspects involved, which are most significant in proper management of gravel deposits and to municipal planning, are part of the domain of a single scientist in the Geological Branch. The only other province which may be so understaffed in this field is Prince Edward Island.

This lone scientist is also responsible for study of other industrial mineral commodities, for example, gypsum, limestone, barite, silica, and many others. Studies such as these which cover the occurrence, access, geology, and grade of deposits are stimulating to industrial development. It is a great pity that the Branch has produced so few of them, and those few so far apart in time. The last was in 1957. It is also a pity that lack of staff has resulted in an almost complete lack of applied research in the industrial mineral field, for example, investigation of the feasibility of recovering titanium from porphyry copper tailings.

A partial answer to the manpower required to satisfy these needs may reside in the Terrain Studies Branch of the Ministry of Environment. There a group of four physical geographers/Pleistocene geologists, under Peter Lewis, work in close association with soil scientists and foresters. Their landform maps are not as useful as they could be, according to several outside respondents, and they could perform a much more useful role by closer association with scientists of the Geological Branch and by combining their present work with projects such as those described in the preceding paragraph.

Consideration should be given to the transfer of this group from the Terrain Studies Branch of the Ministry of Environment to the Geological Branch of Ministry of Energy, Mines and Petroleum Resources to work in collaboration with scientists of the Resource Data and Project Geology sections.

Detailed Mapping

It is probable that the integrated demands from many segments of society related to the use of the surface of the Province will require government authorities to undertake the task of systematically preparing large-scale maps. Land use controversies are presently sufficiently numerous to suggest that a modest beginning is due and that detailed geological studies should commence in areas which are not necessarily of known mineral potential. Such studies would be carried out in collaboration with other regional works and should be carefully integrated with past and future regional projects which are conducted by the GSC.

Mapping programs of this type have been initiated in other provinces, notably in Ontario. The chosen scale in most cases has been 1:50 000. It appears that this would be a suitable scale for the Province of British Columbia. Any such program will take many years, but is best accomplished in a systematic

and persistent fashion. Such a program should have staff exclusively dedicated to it, and should not be required as a part-time activity of other sections.

Geothermal Energy

The potential for geothermal energy in the Province of British Columbia is substantial but ill-defined. Little detailed information exists and most of this has been assembled by the GSC and by industry. Regulation and legislation to handle this resource are lacking. This is an area where the technological expertise of the Branch should take an initiative to establish the necessary management data for sound policy making in advance of the potential conflicts over land use, ownership, and public regulation.

The activity is currently within the jurisdiction of the Division of Petroleum Resources. However, its technology and implications are far more connected to the "hard rock" activities of the Geological Branch.

The Committee recommends the status of this important activity be carefully reviewed.

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